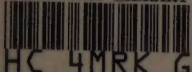


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THE DIAGNOSIS AND TREATMENT OF INTUSSUSCEPTION

CHARLES P. B. CLUBBE

**THE DIAGNOSIS AND TREATMENT
OF INTUSSUSCEPTION**

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THE DIAGNOSIS AND TREATMENT OF INTUSSUSCEPTION

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P R E F A C E

THIS book was written fourteen years ago. It now appears in a Second Edition because it is still being asked for in various places, especially in Canada and the United States. This edition has been completely revised, and embodies the experience gained in treating 270 cases of intussusception. Its main object is to help the young practitioner in diagnosing these cases ; it may also be useful to the young surgeon.

THE AUTHOR.

January 1921.

PREFACE TO FIRST EDITION

THIS book is based entirely on experience I have gained in treating a large number of cases of intussusception during the last thirteen years.

It does not pretend to be an exhaustive treatise on the subject. It aims chiefly at being practical, and deals mainly with diagnosis and treatment, irrigation and its limitations being especially noted.

If it is found to be of any service to young practitioners, my object will have been attained.

THE AUTHOR.

SYDNEY,
October 1906.

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THE DIAGNOSIS AND TREATMENT OF INTUSSUSCEPTION

CHAPTER I

INTRODUCTORY

INTUSSUSCEPTION, i.e. invagination of part of the intestinal tract into the lumen of the gut just below it—has been known and recognised as a cause of intestinal obstruction from time immemorial. In some old books we find it called “Introsusception,” and at one time it was confounded with volvulus.

John Hunter did not make this mistake. It seems that the second paper he read before the Society for the Improvement of Medical and Chirurgical Knowledge was on Introsusception. Hunter’s clear and minute description of the mechanism and anatomy of intussusception could hardly be improved upon at the present day. His treatment, however, was weak. He did not approve of the treatment then sometimes adopted of giving quicksilver, but suggested the administration of “vomits” with a view to inverting the peristaltic action of the containing gut. Mr. Heath in his Hunterian Oration, referring to this paper, says: “It is remarkable that neither

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inflation of the bowel from below, which dates from Hippocrates, nor the proposal of Praxagoras to open the abdomen and thus reach the seat of the trouble, which in modern times has proved so successful, receives any mention in this essay.”

In his *Clinical Lectures* Trousseau, discussing this subject, tells us that in 1676 Paul Barbette, a surgeon of Amsterdam, very distinctly suggested opening the abdomen in obstinate volvulus or intestinal intussusception. But it does not appear that this very rational mode of treatment was carried out by anybody at that time, or for many years after. Indeed, it is not until 1871 that we find a record of an abdominal section for intussusception. A successful case of laparotomy for intussusception in a child was then recorded by Mr. Jonathan Hutchinson.

To Mr. A. E. Barker¹ belongs the honour of putting the treatment of intussusception on a rational basis. It was in 1888 (now thirty-two years ago) that his first paper on the subject appeared. He then argued very forcibly on the importance of operating early. At that time, although he did not pretend to have made an exhaustive search, he could only find records of 73 cases that had been operated upon. Only 12 of these had recovered; 23 of the cases were in children, and of these only 5 had recovered—a mortality of 78·2%. This was not very encouraging; it was, doubtless, the high death-rate that made men reluctant to operate. So it was

¹ *Lancet*, London, August 11th, 1888.

only undertaken as a last resource, several days after the onset of symptoms, and generally when it was clear, even to the uninitiated, that death would take place. Under such circumstances, how was it possible for the death-rate to lessen? Only when men were able to see and appreciate the fact so strongly urged by Mr. Barker—that laparotomy could not be performed too early in any case, after irrigation had failed—did any improvement take place.

Old superstitions and old methods of treatment die hard. Men's fixed opinions are not changed in a day, so it was only quite gradually that men were persuaded to do as Mr. Barker told them. Indeed, I do not see how we could expect the general body of the medical profession to see the importance of early operation, when they were told in all the textbooks of the day that operations on children in these cases were dangerous and only to be performed as a last resource, and that the few successful cases recorded must be regarded as surgical curiosities.

Henoch¹ “recommended the trial of iced enemata every one or two hours. In rare cases, reduction is said to have been produced by hanging the child up by the legs and by massage of the abdomen, patient being under chloroform. In desperate cases laparotomy, with reduction of the intussusception and the formation of an artificial anus, has been often performed, but only very rarely with success. The

¹ *Lectures on Diseases of Children*, translated from 4th edition, New Sydenham Society, 1889, vol. ii.

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reason for this want of success is that, even when the intussusception was found, it was nearly always impossible to draw the invaginated portion out of its sheath. As it is impossible to establish any definite indication as to the exact time when laparotomy should be performed, the physician who risks this operation must himself incur responsibility for the result. Braun has advised operating on the first or second day of disease, if possible, because reduction may probably still be effected at that time ; but the objection to this is that the diagnosis is generally very uncertain in these early stages.”

Even Mr. Jonathan Hutchinson in 1892—although he had twenty years before operated successfully on a child for intussusception—was afraid of laparotomy.¹ When discussing methods of procedure, he says : “ If the patient be an infant, say under two years of age, it will be well to be content with repeated attempts by injection. The results by laparotomy in infants have been so almost invariably fatal, that it is safer to trust to other measures.”

Later still, the writer on Intussusception in the *American Textbook on Diseases of Children* (1894), speaking about the operation, says : “ In cases of acute intussusception it has no effect in diminishing the death-rate. The objections to the operation in acute cases are that there is a reasonable chance of recovery without it.” He goes on to say : “ I am well aware that a few brilliant results from laparotomy

¹ *Arch. Surgery*, London, vol. iv.

in infants have been recorded by Mr. Hutchinson and the late Dr. Sands, of New York, and other operators ; but these cases should be regarded as surgical curiosities, showing what infants may sometimes safely endure, rather than as furnishing precedents for future guidance."

And so it was only very gradually that opening the abdomen for intussusception became recognised as the right method of treatment.

In 1895 Mr. Roughton¹ could only find records of 16 successful cases of laparotomy for intussusception.*

As time went on, many more cases were recorded from all parts of the world, but the mortality was generally high. The death-rate for intussusception depends entirely upon the time (in hours) in which it is recognised after the onset of symptoms. If all cases could be diagnosed and dealt with in the early stage, the mortality would not, I suppose, be greater than that for the removal of the appendix in the quiet stage.

Medical men are now more alert than they used to be. Formerly it was extremely rare to get a case sent into hospital until two days had elapsed from the onset of symptoms. Now it is common enough to get cases sent in a few hours after the symptoms have been first noticed.

The great increase in the number of intussusceptions admitted to hospital everywhere does not indicate that

¹ *Lancet*, London, 1895, vol. i.

² This can hardly have been a complete list, as I myself had had three recoveries by the end of 1894.

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intussusception is now more common than formerly ; it shows that some men are becoming better educated and more careful, and more often recognise these cases at first sight. Many children's deaths from intussusception in former years were, without doubt, signed up as from colitis, dysentery, convulsions, etc.

It must be very difficult for the medical man who, perhaps, has not met with a case during his student days, or ever heard a clinical lecture on the subject, and whose sole knowledge of intussusception has been gained from a textbook on surgery read for his examination, to recognise a case of this sort when first he meets it. The textbooks, as a rule, do not lay stress enough on certain symptoms, and do lay, perhaps, too much on others. It is probable that a man whose knowledge of this subject has been derived from textbooks would expect to find without difficulty a definite tumour in the abdomen in all cases. He would also, I think, expect to find the child looking very seriously ill. Now often in the early stages these children do not appear ill ; and very often it is not possible to make out any tumour unless the child is under an anæsthetic.

The main object of this book is to indicate plainly the early signs and symptoms. Until the great body of general practitioners have been taught the importance of recognising intussusception in children in the early stage, and also the extreme importance of dealing with the condition without any delay, we cannot expect a reduction in the mortality.

CHAPTER II

STATISTICS

THE total number of cases of intussusception that have been under my care amounts to 270, of whom 166 were males, or 61·5%, and 104 females, or 38·5%. The males always predominate, for some unknown reason. Barnard states that at the London Hospital out of 189 cases 131, or 70%, were males; and in 788 cases quoted by Fitzwilliams, 68% were males and 32% females. Under 12, he says, the ratio is 3 to 1.

Mr. D'Arcy Power, in his Hunterian Lectures, believed that intussusception at the ileo-cæcal valve would be more easily produced if the ileum sloped upwards towards the cæcum, than if the ileum approached it from above downwards—as an invagination in the former case would readily pass up the ascending colon; and he thought that the female ileum might possibly, on account of the presence of the uterus, slope downwards towards the valve more frequently than the male ileum, and so be more favourably situated to prevent invagination. But Fitzwilliams, after investigating this matter in 48 children (27 males, 21 females), found that in girls the ileum sloped up in 71% of the cases and down in 5%. In boys the ileum sloped up in 52% and down in 11%.

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As to ages : the age of the youngest child was just under three months, and the ages of six other children were given as three months (of these five recovered and one died).

TABLE OF AGES

0 up to 6 months	.	.	125 cases, 46.2%
6 to 12	„	.	113 „ 42.3%
12 „ 18	„	.	12 „ 4.4%
18 „ 24	„	.	14 „ 5.2%
over 2 years	.	.	6 „ 2.2%
			270 „

This table shows that 235 cases, or 88.5%, were under one year of age, and only 6 over two years. Of the 6, one was 15 years old, one 11, one 10, one 9, one 7, and one 3½ years.

Of the 270 cases, 216 recovered and 54 died, showing a mortality of 20%. There were 253 abdominal sections ; of these 199 recovered and 54 died, a mortality of 21.3%. In 17 cases the intussusception was reduced by irrigation ; all these recovered.

Of the section cases (taken in chronological order)—

In the first 50, 25 died	.	.	Mortality 50%
„ second 50, 12	„	.	25%
„ third 50, 4	„	.	8%
„ fourth 50, 3	„	.	3%
„ fifth 50, 10	„	.	20%

It will be observed that the results in the third and fourth " 50s " were exceptionally good. Only seven deaths in 100 consecutive sections for intussusception must be quite unusual. And, although one could hardly expect this extremely low mortality to be maintained, it was disappointing that the fifth " 50 " showed such a marked rise in the death-rate.

But, on looking over the notes of these ten fatal cases, I find that eight were practically doomed before they got to the hospital. They all came too late ; they had been " treated " outside. In four the bowel was gangrenous, and had to be resected ; in four more, although the bowel was not gangrenous, the intussusception was only reduced with difficulty, they were not able to rally from the shock of the operation, and died in from two to eight hours. In one the intussusception came on during an attack of diarrhoea. The child was in very poor condition, and died in forty-eight hours. The tenth case got over the operation, but died in three weeks from erysipelas, caught from some other child in the ward.

The average mortality now, when dealing with a large number of cases, is about 20%. It ought to be lower ; but, of course, the mortality always depends upon the interval between the onset of symptoms and the beginning of surgical treatment. If cases could reach the surgeon within twelve hours, I think the mortality would be almost nil : even after eighteen hours the chances are good. After thirty-six hours the chances begin to decrease rapidly. The only way

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to lessen the mortality, then, is to educate medical men to recognise these cases when they are first seen.

AVERAGE TIME FROM ONSET OF SYMPTOMS TO TIME OF OPERATION

		In those that lived.		In those that died.	
First	50	.	28 hours	.	68 hours
Second	50	.	23 „	.	48 „
Third	50	.	19 „	.	36 „
Fourth	50	.	47 „	.	49 „
Fifth	50	.	16 „	.	48 „

CHAPTER III

ANATOMY—PATHOLOGY—ETIOLOGY

ANATOMY.—The condition called “intussusception” is caused, according to John Hunter, “by the passing of one part of the intestine into the other,” and commonly by the “upper passing into the lower.”

An intussusception may start at any part of the bowel, from duodenum to rectum. In the great majority of cases (97·6% of the 253 cases I have personally seen) it starts at the cæcum, or in the lower end of the ileum. Certain anatomical points may now be considered.

In describing the *Ileo-cæcal Valve*, Cunningham¹ says: “Where the ileum enters the large intestine, the end of the small gut is, as it were, thrust through the wall of the large bowel, carrying with it certain layers of that wall, which project into the cæcum in the form of two folds, lying respectively above and below its orifice, and constituting two segments of the ileo-cæcal valve. The condition may be compared to a partial inversion or telescoping of the small into the large intestine: it must be added that the peritoneum and the longitudinal muscular fibres of the

¹ Cunningham, *Textbook of Anatomy*, 2nd edition.

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bowel take no part in this unfolding ; on the contrary, they are stretched tightly across the crease produced on the exterior by the inversion, and thus serve to preserve the fold and the formation of the valve. . . .

“ *Structure of the Ileo-cæcal Valve.*—Each segment of the valve is formed of an infolding of all the coats of the gut, except the peritoneum and the longitudinal muscular fibres, and consequently it consists of two layers of mucous membrane with the submucosa and the circular muscular fibres between, all of which are continuous with those of the ileum on the one hand and of the large intestine on the other. The surface of each segment turned towards the small intestine is covered with villi, and conforms in the structure of its mucous membrane to that of the ileum ; whilst the mucous membrane of the opposite side resembles the mucous coat of the large bowel.”

Mr. D’Arcy Power,¹ giving the results of examination of 44 ileo-cæcal valves, says : “ The ileum nearly always projected for 4 to 7 millimetres into the lumen of the intestine, sometimes as a conical process, at other times more on one side than upon the other ; and in a few cases the mucous membrane of the ileum was distinctly prolapsed into the large intestine.”

The great motility of the cæcum depends upon the fact that it is nearly always completely covered by peritoneum on all its aspects, and lies quite free in the abdominal cavity.

The mesentery of the small intestine is attached to

¹ *Hunterian Lectures*, 1897.

the posterior abdominal wall obliquely from the left side of the second lumbar vertebra to the right iliac fossa.

D'Arcy Power goes on to discuss the length of the mesentery, which, he says, "in proportion to the body, is much greater in infants than in older children. Increased length of mesentery is necessarily associated—other things being equal—with an increased range of movement in the intestine. The intestines, therefore, should be capable of a greater range of movement in children than in adults."

Peyer's Patches, which probably play an important part in about 40% of intussusceptions, "consist of a large number of lymphoid nodules grouped closely together so as to form a slightly elevated area usually of oblong form on the surface of the mucous membrane. In length they vary from $\frac{1}{2}$ inch or less to 3 or 4 inches, and in width they commonly measure from $\frac{1}{3}$ to $\frac{1}{2}$ inch. Their number is variable, and they are best marked in young subjects, where they form considerable elevations above the general surface. . . . They are invariably situated along the free surface of the intestine, opposite the line of mesenteric attachment, with their long axis corresponding to that of the bowel. . . .

"Peyer's Patches are entirely confined to the small intestine, being largest and most numerous in the ileum in its lower part."¹

An vertical section of an intussusception presents six

¹ Cunningham, *Textbook of Anatomy*.

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layers of bowel, three on either side of the central canal; a cross-section shows three concentric rings. If the layers are examined, it will be found that peritoneum is always in contact with peritoneum, and mucous membrane with mucous membrane.

“All parts are named, and the nomenclature has suffered somewhat from an exuberance of terms. The external of the three layers is known as the ‘intussusciens,’ the sheath or receiving layer (*la gaine* of the French). The innermost cylinder is known as the ‘entering’ layer, and the middle one as the ‘returning’ layer. Taken together, these two layers form the intussusceptum (*le boudin* of the French). The ‘neck’ of the intussusception is at its upper part, where the returning layer joins the sheath. The ridge formed by the junction of these two layers is known as *le bourrelet*. The apex of the intussusception is at the lower part of the intussusceptum, where the entering and returning layers join. . . . All intussusceptions are complete, in the sense that the intussusceptum is composed of all the coats of the bowels, and that it enters the sheath evenly and equally.”¹

Duncan Fitzwilliams in his most valuable paper, *The Pathology and Etiology of Intussusception*,² discussing the method of growth, says: “The apex of the intussusception remains constant, or changes only to a very slight degree. . . . The growth of an intussusception is due to muscular force, and that muscular

¹ Treves, *Intestinal Obstruction*.

² *Lancet*, February 29th, 1908.

force is supplied by the involuntary muscle of the intestinal wall.

“ It would seem that the sheath is the only part of the intussusception which can influence the growth of the intussusceptum. The returning layer is turned inside out, and peristalsis, even if it were possible in this position, will pass from apex to neck, tending to expel the inner tube from its interior ; while the inner tube for its part may contract and extrude its contents, but has no power to worm its way through the returning layer. Any idea of the inner tube passing through the middle is discountenanced at once by the stiff oedematous state which congestion causes the apex rapidly to assume, rendering it quite impossible for the inner tube to roll round and become part of the returning layer. The sheath, then, must supply the whole of the muscular force ; but it can only act on the intussusceptum as a whole, and can have no influence on the passage of the inner through the returning layer.

“ These considerations render it quite impossible for an ileo-colic intussusception to occur by the method which up to the present has been accepted without question.”

Fitzwilliams shows quite clearly that an intussusceptum grows entirely by contraction of the longitudinal fibres of the sheath, the circular fibres being merely a fixed point. In discussing the rôle of the mesentery, he shows that as the growth proceeds the mesentery exerts an influence on the shape of the

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tumour, and tends to check the onward passage. "Its drag is chiefly felt along the attached border of the inner and returning layers, so that the intussusceptum assumes a curved shape, the concavity being towards the root of the mesentery. . . . The spiral twist which is sometimes found in extensive invagination, and which may occasionally be one of the obstacles which prevents reduction, is the direct result of the intussusceptum travelling in a corkscrew-like manner round the root of the mesentery."

He goes on to state that it is only partially true that, in all forms of intussusception, the starting-point remains the apex of the intussusceptum; in certain circumstances a slight movement does take place.

"The drag of the mesentery, besides causing the curved appearance, will anchor the attached margin of the lumen of the gut, and tilt the apex to one side; the opposite free margin will then form the apex." In this way he explains the dimple in the cæcum so frequently found in those cases where the head of the cæcum is the last part to unfold, and which, for this reason, have often been classified as a separate variety. But it is in reality an ileo-cæcal form, the dimple on the outer wall of the cæcum being the part which has slipped down in front of the valve. He adds, "In those rare cases in which the intussusception has been reduced by operation and returns within twenty-four hours, it is quite possible that the dimple is the direct cause of the second invagination; but only in these instances can it be classed among the causes."

This point was also noted and emphasised by Walton¹ in his paper on Intussusception.

PATHOLOGY.—The pathological changes in an intussusception are caused by the compression of the vessels of the mesentery. When once an acute invagination has started, it is easy to understand how the symptoms (of obstruction) are produced. The entering mesentery soon gets stretched and twisted, thus blocking veins and lymphatics. The distended veins give way, and blood is poured out in the submucosa and on the surface. The intussusceptum swells and becomes hard. It is this swelling and thickening of the apex of the intussusception that makes it difficult to effect the reduction—and in a certain number of cases makes it impossible.

In very acute cases, as the mesentery becomes more twisted, the arterial supply may be cut off; gangrene of the intussusceptum soon follows.

I have never seen any adhesions in any cases I have handled, although I have looked for them. There has often been very great difficulty, just at the extreme end, in getting the stiff, swollen, thickened intestine to unfold. The surface of the bowel has often been maroon-coloured. The peritoneal surface has been rough and granular-looking at the starting-point, especially when it began at the caput cæci or in the ileum a few inches above the cæcum. In the irreducible cases, too, after the intussusception has been resected, I have never seen anything that could be

¹ *Practitioner*, August 1911.

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called an adhesion. The intussusception has often been irreducible, even after removal; but this has always been due to swelling and thickening of the intussusceptum which made evolution almost an impossibility.

ETIOLOGY.—Mr. D'Arcy Power, in *Hunterian Lectures on the Pathology and Surgery of Intussusception*, delivered in 1897, inclined to the opinion that a disproportion between the width of ileum and cæcum was one of its main causes. His conclusions are: "The evidence derived from anatomical, physiological, pathological, and clinical data render it legitimate to assert that spontaneous ileo-cæcal intussusceptions occur where the colon is considerably larger than the ileum, and is so unduly movable that it readily allows itself to become invaginated when once the process has begun. This variety of intussusception is essentially an affection of childhood; and such an undue increase in the width of the colon implies either a congenital abnormality or an unduly rapid growth, for at birth the diameter of the large intestine is practically the same as that of the ileum.

"Though anatomical peculiarities are important factors in the production of an intussusception, the physiological factors are no less important, for they apply in all probability to every form of spontaneous invagination, whether it is of the enteric variety, the ileo-cæcal, or the colonic. The physiological factor is much less easy to specify than the anatomical, for it is almost certainly an individual peculiarity. It may

be stated broadly, however, that, as regards the ileo-cæcal portion of the intestine, the increased mobility, coupled with the unduly rapid growth in the width of the large intestine, is probably associated with increased and irregular peristaltic movements of the large intestine."

Nothnagel¹ goes very fully into the question of the etiology of intussusception. He is of opinion that in the majority of cases "it must be admitted that spasm is the primary condition, or that conditions exist which favour the mechanical invagination of the bowel. If I understand this matter correctly, the true sequence of events is the following: While the bowel is performing normal peristaltic movements, an annular and strictly local constriction of the bowel happens to occur. This constriction may be greater than normal, and so pronounced that the limit of physiologic invagination is exceeded, and the first degree of pathologic intussusception develops—exactly in the same manner as it has been seen to do in our experiments. It is quite unnecessary to invoke any primary 'causative' factor—all that is needed is a simple increase in the intensity of the normal movement of the bowel, which of itself is sufficient to produce this dangerous condition. On this basis, too, the great predominance of invagination of the bowel in early childhood can be satisfactorily explained, for it is usually admitted that at this age the bowel is more irritable and more motile than in later life. The proof

¹ *Diseases of the Intestines and Peritoneum.*

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of this assumption is that the so-called agonic form of invagination is most frequently found in the bodies of children."

In all statistics the ileo-cæcal is the variety most commonly met with, then the entero-colic (double). In my own series of cases there were—

146 cases classed Ileo-cæcal	. .	57·6%
80 ,, ,, Entero-colic	. .	31·8%
and 21 ,, ,, Ileo-colic	. .	8·4%
Total . .		97·8%

And if we accept Fitzwilliams' explanations as to the formation of the ileo-colic variety, then it, too, must be classed with the enteric variety, starting quite low down in the ileum.

97·8% of my cases started either at the ileo-cæcal valve or at the lower end of the ileum. Does not this show that in most cases the main etiological factor in the starting of an intussusception is anatomical?

Dunbar¹ makes a point of "the extraordinary projection of the termination of the ileum into the colon. . . . This projection at any rate must constitute one of the strongest predisposing anatomical factors to intussusception; and, when it is present to a marked degree, one might almost say that there is a constant incipient intussusception in existence."

For those starting in the lower part of the ileum,

¹ *Scottish Medical and Surgical Journal*, August 1906.

Peyer's Patches seem to me, without doubt, to be the main predisposing cause. How frequently do we find, when we unfold the intussusception, that it started in the ileum close to the cæcum ; we also find the thickened dimple on the side of the ileum opposite to the mesentery, i.e. the situation of a Peyer's Patch.

In one of the few colonic forms I have met with, the intussusception had been caused by an abnormal shortening of a longitudinal band.

CHAPTER IV

VARIETIES

THIS question has been dealt with fully by many writers—Corner,¹ Cuthbert Wallace,² Walton,³ and, notably, Fitzwilliams.⁴ The papers should be referred to by those interested. I think all agree that an attempt should be made to cut down the redundant nomenclature that is accumulating around intussusceptions occurring at and about the ileo-cæcal junction.

In the 253 laparotomies I have done, I have noted at the time of the operation the kind of intussusception I was dealing with. In 77, i.e. in 30%, of the cases the head of the cæcum was the last part to unfold. I found it often much thickened and discoloured, with a definite dimple which often required a little manipulation to press out.

Fitzwilliams and Walton have both clearly shown that, although the caput cæci has become the apex of the intussusception, this is a secondary effect, the original apex of ileo-cæcal valve being dragged round so as to face the inner wall.

¹ *Annals of Surgery*, vol. ii, 1903.

² *Ibid.*, vol. i, 1905.

³ *Practitioner*, vol. ii, 1911.

⁴ *Lancet*, February 29th, 1908.

Sixty-nine cases were simple ileo-cæcal forms ; if we add to those the 77 where the head of the cæcum was the last part to unfold, and call them all ileo-cæcal, we have 146 of this variety, or 57·6% of the total number of cases operated upon.

The next in frequency in my series are the double varieties—45 ileo-colic-colic, 35 enteric-ileo-cæcal.

By ileo-colic-colic I mean an intussusception that has gone through the valve (forming what was called an ileo-colic-form), and has increased at the expense of the cæcum and colon. At the time of the operation, after the cæcum has been quite unfolded, a mass can still be felt in the cæcum. To get this mass out sometimes requires a little time, patience, and squeezing and gently pulling alternately. Occasionally it comes quite easily. When this bit of ileum is reduced, it is sometimes found to be intussuscepted.

In those I have classified as enteric-ileo-cæcal, an enteric intussusception has formed in the ileum, at variable distance from the cæcum—very rarely more than 6 inches. When this arrives at the valve, it does not pass through, but pushes the valve in front. The intussusception now increases at the expense of the cæcum and colon. At the time of the operation, while the cæcum is unfolding, an enteric intussusception can be seen emerging ; and, when the cæcum is quite reduced, it is found to be empty. If the enteric intussusception is then examined, it is often found to be a thickening of the wall of the ileum opposite the mesentery, with a distinct dimple ; or it may be a

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complete circular intussusception of the ileum some inches away from the valve.

It seems to me that the ileo-colic-colic and the enteric-ileo-cæcal are distinct varieties of the double form of intussusception, and can always be easily differentiated at the time of operation; but, for simplicity's sake, I have no objection to calling both entero-colic. If this is done with this series of cases, we have 80 entero-colic forms, i.e. 31·8%.

I have met with 21 cases that I named ileo-colic. When this form of intussusception is examined before reduction, you find that the cæcum is not infolded; the whole of the appendix can be seen. A small amount of ileum is found in the cæcum through the valve. When this is reduced, no intussusception of the ileum can be seen.

It was generally supposed that, in this intussusception, the ileum "prolapsed" through the valve, and that as it increased in size its apex constantly changed. Fitzwilliams has clearly demonstrated that this is not the case.¹ He very clearly shows, and illustrates, the true mechanism by which these so-called ileo-colic intussusceptions are formed. The simple ileo-colic forms, then, do not start at the valve, are enteric in origin, and have started by the mechanism common to all forms of intussusception; and Fitzwilliams says, "The so-called ileo-colic form should not be described as a separate variety of intussusception, but should be grouped with the enteric cases."²

¹ *Lancet*, 1908.

² *Ibid.*, February 29th, 1908.

Apart from the so-called ileo-colic forms, I have only met with one true enteric variety. The child was eight months old, and was operated on forty-eight hours after the onset of the symptoms. The intussusception was a small one in the ileum, a long way from the cæcum. The child died in six hours.

If we eliminate the ileo-colic form, and class it as enteric, I have had 22 of this variety, or 8·4%.

I have only come across 5 of the pure colic form, and one of these was a recurrence six months after the first operation.

I have only seen one case of intussusception of the appendix; this was a case that belonged to my colleague, Dr. E. H. Binney.

DOES THE VARIETY INFLUENCE THE MORTALITY?—The following table gives the number of cases in each variety, the mortality, and the time between onset of symptoms and operation in those that recovered and those that died:

	Variety.	Cured.	Died.	Mortality.	Hours from Onset of Symptoms.	
					In those Cured.	In those Died.
77	Cæco-ileo-cæcal . . .	59	18	23·6%	21	42
69	Ileo-cæcal . . .	51	18	25·7%	15	47
45	Ileo-colic-colic . . .	38	7	23·6%	17	51
35	Enteric-ileo-cæcal . .	26	9	26·4%	16	40
22	Enteric (21 ileo-colic) .	15	7	31·8%	22	49
5	Colic	4	1	20·0%	16	10 days
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If we simplify the varieties :

	Variety.	Per- cent- age.	Cured.	Died.	Mortality.	Hours from Onset of Symptoms.	
						In those Cured.	In those Died.
146	Ileo-cæcal . . .	57.6	110	36	25.0%	18	45
80	Entero-colic. . .	31.8	62	18	22.9%	16	46
22	Enteric	8.8	15	7	31.8%	22	49
5	Colic	2	4	1	20.0%	16	10 days
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One would have supposed that the mortality would be heaviest in the double varieties ; but this table shows that, in this series of cases, the enteric variety had the highest mortality—also the interval between first symptoms and operation was longer in these cases. It cannot be said, then, that the variety has much influence on the mortality ; that depends more upon the time that has elapsed after onset of symptoms and before the child is operated upon.

Should we be able to diagnose the particular variety of intussusception that we are dealing with before we open the abdomen ?

Dr. Hamilton Russell,¹ in recording a case of colic intussusception in a boy of six years of age, said : “ Early and rapidly increasing distension is the most striking and distinctive feature of large bowel intussusception . . . and constitutes a character of broad distinction from anything witnessed in the ileo-cæcal form of the affection.”

In all varieties a distended abdomen may be, and

¹ *Intercolonial Medical Journal of Australasia*, vol. ii, 1905.

not infrequently is, met with in late cases. (By "late cases" I mean those not operated on until thirty-six hours after the onset of the symptoms.) It is not a common symptom in early cases, though I have met with it; but I cannot call to mind any one occasion when this symptom was associated with the colic variety of intussusception. I do not think it is possible to diagnose the colic variety by this symptom. Neither do I see much practical advantage in so doing. Of course, if we could be absolutely certain because of this symptom—distension—that we were dealing with a colic variety, then we might (especially in early cases) hope for complete reduction by the use of irrigation. Unfortunately, we do not always get the cases early, and how many of us can be certain that we are dealing with a colic variety because the child's abdomen is distended?

The last case of colic intussusception that I had anything to do with (not in this series) was the child of an officer returning from the War. It was seven months of age, and suddenly developed the symptoms of intussusception while at sea. Under an anæsthetic a mass was felt on the left side of the abdomen, which was not distended. The child was operated upon by Major Savage on a Saturday afternoon on the ship at sea. The intussusception, which was found to be a pure colic variety, was easily reduced. They did not disembark until Monday morning. I saw the child in the middle of that day at a private hospital. The abdomen was then somewhat dis-

tended, and there was occasional vomiting. I was told that there had not been any movement of the bowels since the operation forty-four hours before.

The child was very apathetic, and the pulse frequent and very soft. It was at once put on pituitrin (two drops every two hours), and the bowel was washed out from time to time with saline. This unsatisfactory condition continued for two days; then the child began to pass fæces, and very soon afterwards got well. In these cases of intestinal obstruction following an operation one is very much tempted to open the abdomen to see if the intussusception has recurred. In this case the child was so feeble that I did not think he would stand the shock of another section. I thought, too, the chances were that he had no recurrence, but that the symptoms were due to faulty peristalsis, such as one does sometimes see after abdominal sections, especially if the bowels have been much handled. This child, too, I was told, had had morphia just after the operation. In the end it turned out that I was right in my interpretation of the symptoms.

CHRONIC FORMS OF INTUSSUSCEPTION.—Chronic forms of intussusception are not common in young children, but they are met with. In this series I have records of 8 cases that may be tabulated as of the chronic form, but only 2 were actually operated on in the chronic stage; the other 6 had been chronic, but had become acute before admission to hospital.

Age.	Duration.	Variety.	Cured.	Died
11 months	8 days	Entero-colic	1	—
10 „	10 „	Colic	—	1
7 „	13 „	Ileo-cæcal	—	1
3 „	7 „	Ileo-colic-colic.	1	—
8 „	9 „	Ileo-cæcal	1	—
9 „	13 „	Ileo-cæcal	1	—
8 „	12 „	Ileo-cæcal (operated on in chronic stage)	1	—
10 „	10 „	Ileo-cæcal (operated on in chronic stage)	1	—
Average: 8		Total	6	2

The history is sometimes indefinite in these cases, but often the onset is sudden; there are abdominal pains, vomiting attacks, sometimes diarrhœa; the pains come on after food. In the cases that remain chronic there is much emaciation, and the child has the typical “abdominal” face. On examination a tumour can be felt, often soft at first, but getting harder as peristalsis takes place.

The treatment is the same as for the acute variety; the abdomen should be opened.

RETROGRADE INTUSSUSCEPTIONS.—Retrograde intussusceptions, superimposed on the usual descending form, are not common. I have only met with two cases. In one the retrograde intussusceptions were multiple—three or four small ones in the ileum, well above and away from the ordinary intussusception. The other case—an ileo-cæcal intussusception after reaching the descending colon—appeared to form a retrograde movement, and was invaginated into the colon higher up.

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Quite recently Dr. Philip Buckley ¹ has given a very interesting account of a “ Superimposition of a Retrograde upon a Direct Intussusception,” which all those interested on this point should read. Dr. Buckley does not think that the usual explanation—that the retrograde intussusception swallows the direct one—is satisfactory, and he certainly gives good reasons for not accepting it.

¹ *Brit. Med. Jour.*, November 22nd, 1919.

CHAPTER V

SYMPTOMS—DIAGNOSIS

THE very sudden onset in a previously healthy baby is a peculiarity of intussusception. The child is seized quite suddenly; screams, turns pale, vomits, and in a short time seems to recover itself, only to cry again at intervals as if in pain. Soon after the first scream it may pass a normal motion. In the great majority of cases (97%) blood will be passed *per rectum* in from two to ten hours. The mass, which varies much in size and position, can nearly always be made out by careful palpation when the child is under an anæsthetic. The child may not look ill; its pulse-rate may be hardly raised, and its temperature may be normal.

It is of the utmost importance that these cases should be diagnosed early. They should always be diagnosed when first seen by the doctor. If the case is not "spotted" at once (i.e., on the first attendance of child at the Casualty or O.P. Room of a hospital, or at the doctor's house, or, in the case of well-to-do people, on the doctor's first visit), valuable time will be lost, and the chances of the child's recovery very considerably reduced. Among the poor, missing an

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intussusception at the first attendance always means a delay of twelve, and very often of twenty-four, hours. It is easy enough to diagnose a case of intussusception when the symptoms have existed for three days. At this period the child will look very ill, its pulse will be quick and its temperature will be raised. There will be the usual history of a sudden onset, vomiting at frequent intervals, straining, and the passing of blood and mucus in the place of fæces. Then, if an examination is made, there will be the very obvious tumour on the left side of the abdomen or in the rectum. But generally, under such circumstances, the diagnosis is useless. It is too late. The time for any hopeful treatment is swiftly passing, if it has not passed. The large majority of cases, if left until they get into this condition, will die. They are already poisoned ; they have no resisting power, and rarely recover from the shock of a laparotomy. Yet case after case has been sent to hospitals in this condition. Even now we get children brought to us in this pitiable condition, though not so frequently now as in former years ; and then in almost every instance we find, on inquiry, that the child has been taken to a doctor within a few hours of the onset of symptoms, and has been “ treated ” by him during the two or three days that have elapsed since the child was first taken ill.

These cases must be diagnosed early. It is hard to understand how they can be missed, if ordinary care is exercised.

The general appearance of the child is, I feel sure, frequently the cause of mistakes in diagnosis. Children in the early hours (six to twelve) of intussusception often do not look sick. Men cannot bring themselves to believe that these healthy-looking, perhaps laughing, babies can have intestinal obstruction. Yet such is the case. The child at the first onset turns pale, looks very ill, and screams ; but it is wonderful how quickly some of them recover themselves. They cry only at intervals, when they get the griping pains, as the intussusciens makes fresh attempts to force along the intussusceptum. If you want to avoid falling into error, I advise you always to listen to the story of the mother when she comes to you with her baby. Some men discount everything told them by children's parents and attendants, and so, going entirely on the appearance of the "intussusception" children, are misled. We must be guided to a large extent by the history we get from the mother. In no other disease does it convey so much to those who have ears to hear. It is nearly always something to this effect : the baby was quite well, when suddenly (often just after taking the breast or after passing a motion) it screamed or cried out, turned pale, and soon vomited. The screaming only continued for a short time, and the pallor soon disappeared, but the child seemed to be uneasy, and got frequent attacks of pain. We find on inquiry that it passed a natural motion soon after the first screaming fit.

When the child is first seen by the doctor, it has

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almost certainly been passing blood by the bowels : this has frightened the mother. She thinks nothing of the sudden screaming of the child, or of its turning pale—perhaps she has forgotten all about it until you remind her by your questions. Babies often scream and go pale and vomit, and the mother thinks nothing of it. But directly she sees blood in the motion she knows something is wrong, and hurries off to a doctor as soon as possible. When you are told by a mother that her child has been passing blood, you should always ask certain questions before you send it away. If you are told that the child was quite well until a few hours ago, when it screamed, turned pale, and vomited ; that it has been fretful and has vomited a few times since ; and that it has just passed some blood, you can be morally certain that you have a case of intussusception to deal with. Then, instead of sending the child away after ordering it some castor oil, you must proceed to verify your diagnosis by careful examination.

An extraordinarily large number of cases with this perfectly clear, straightforward, definite history are missed, and so only come into hospital when the chances of their recovery are of the slenderest. Mothers often tell our house surgeons something of this kind : “ Baby was quite well till three days ago, when he was taken bad quite suddenly in the morning. He screamed and sicked up his bottle, was very fretty all day, kept crying and drawing up his leg. In the afternoon what came from him was pure blood. I

was frightened, and took him straight to the doctor. He looked at him and said, ' Give him a dose of castor oil.' I did, but he threw it up. Took him to the doctor next day, 'cause he seemed no better, and kept passing blood and straining. He looked at him and gave me a bottle of medicine. To-day, when I went, he could see the child was very much worse. He felt his stomach, and sent me straight here with a note." With such a clear history, every child should be examined when first seen. If the doctor is too busy to examine such cases, he should send them at once to a hospital as suspected intussusception. I wonder how many children all over the world have been sacrificed in this way—with a dose of castor oil and a bottle of medicine! If men would only pay attention to the mother's story, very few intussusceptions would ever be sent away undiagnosed. The suddenness of the attack in a child previously quite well; the scream, followed by the pallor, sometimes described as " fainting " or " stiffening " out; then the subsequent vomiting and straining; fits of crying from time to time, intervals when the child seemed all right—with these facts before him, even without the story of any passing blood, the doctor should strongly suspect intussusception.

Cases are sometimes missed even by men who have suspected intussusception and examined for it. They feel the abdomen; they may even make a rectal examination. The child is probably screaming when they are examining the abdomen, so it is not surprising

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that they detect no tumour ; then they find nothing in the rectum, because the mass has not had time to get there. After this examination with negative results, and seeing that the child does not look at all ill, they persuade themselves, despite the history, that it cannot be a case of intussusception.

In some textbooks the mass in the rectum is mentioned as the diagnostic sign. As an aid, however, to diagnosis in the early stages of the disease this symptom is valueless, because, as a matter of fact, the mass rarely reaches the rectum within twenty-four hours of the onset. Of what use is it, then, as a diagnostic sign ? It is only a trap to catch the unwary.

A recent writer, describing symptoms, says under the head of " Shock " : " This condition in acute cases is always well marked, etc. etc. . . . Within a short time the eyes become sunken and lose their lustre, and the features become pinched and drawn, so that the appearance becomes very characteristic, *and in some cases a correct diagnosis can be made from it alone.*"

But what is meant by acute cases ? Surely all cases of intussusception are acute, except the very rare chronic forms. As a matter of fact, you hardly ever get any symptoms of shock until after twenty-four hours have elapsed since the onset ; and no symptoms of profound shock, such as will (according to this author) by themselves ensure a correct diagnosis, occur until about forty-eight hours have elapsed. Of what practical use is a diagnosis when

such a stage is reached? Men must be taught to diagnose these cases before much shock comes on. Nearly every child shows initial shock when the intussusception starts. The child cries, becomes pale, and may faint; but this soon passes off, and the child may appear to be all right again for some hours, crying only occasionally when he gets the pain.

Very occasionally the shock persists from the very onset of the symptoms. My colleague, Dr. Wade, had a case of this kind. The child was admitted to hospital four hours after the onset of symptoms, and it had not rallied from the initial shock. When operated upon, the mass was found in the rectum. The rapidity with which this intussusception travelled would, no doubt, account for the persistence of the long-continued shock.

I do not see how young medical men can be expected to diagnose these cases early if they rely on, and derive all their knowledge of the symptoms from, the clinical picture presented to them in most of the textbooks. It seems to me that many of these descriptions are misleading.

Although the onset is nearly always sudden, and the child has previously been well, we must remember that intussusceptions may take place during a diarrhoea. In my series of 270 cases, intussusception came on during an attack of diarrhoea in 6 cases—i.e. 2·17%.

We should suspect intussusception when we are told that the child, who had had diarrhoea for some

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days, seemed suddenly to get worse and to suffer much pain ; that it vomited ; and that after a few hours the motions, instead of being blood-stained mucus and fæces, contained much more blood and very little, if any, feculent material. With this report from a nurse or mother, we should carefully examine in the usual way for an intussusception.

It may sometimes be difficult to distinguish between intussusception and acute colitis, in cases where the meso-colon is thickened and feels very like the intussusception tumour ; but the difficulty should not be insuperable, if the case is carefully gone into. The onset in both cases may be sudden ; but in intussusception the obstruction is generally complete after a few hours—whereas in colitis there are frequent motions mixed with blood and slime. The tumour in colitis is generally much longer and less definite in shape than in intussusception ; and, although the mass can be made out low down in the abdomen on the left side, it can never be felt as a mass in the rectum.

Henoch's purpura may, and does, give rise to symptoms akin to those of intussusception ; indeed, an intussusception may actually occur during an attack of Henoch's purpura.

Hugh Lett¹ records a case of Henoch's purpura complicated by the presence of two separate intussusceptions occurring at an interval of seven days. The patient was a boy three years old. This child

¹ *Lancet*, February 20th, 1919.

was taken ill on September 27th. He complained of pain in the knee, which was found to be swollen, as was his elbow. The next day "purple watery blisters" were noticed on the left leg, and the left ankle was swollen. On the morning of the 28th he was suddenly seized with acute abdominal pain that made him scream, and had screaming fits at intervals until admission to hospital next day. On admission, small purpuric patches were noticed on ears, legs, and scrotum. The abdomen was slightly distended, and palpation revealed a sausage-shaped mass in the right lumbar region. At the operation an ileo-cæcal intussusception was found, which was easily reduced. On September 30th his pulse was normal; there was no vomiting; a natural motion passed, but the purpura was a little more marked. On October 2nd diarrhoea set in. By the 3rd the purpura had considerably increased. On the 6th the child vomited four times, and complained of abdominal pain. He died on the 9th. The necropsy showed that there was general septic peritonitis. An enteric intussusception was found 18 inches from the ileo-cæcal valve; it was 5 inches long, and irreducible.

The main symptoms of Henoch's purpura are the presence of purpuric spots, swelling of joints, abdominal pains, intestinal hæmorrhage (passing of blood and slime), and vomiting. What sometimes makes the diagnosis so difficult is the fact that the abdominal symptoms may precede those of purpura. But, unless we can feel a tumour, we should not

diagnose intussusception, as this can be felt in practically every case if carefully examined. In doubtful cases, therefore, it is better not to open the abdomen unless a tumour can be felt.

Collinson¹ reported a case of Henoch's purpura, complicated by intussusception, in a child four years old. The intussusception was of the enteric variety, was found to be irreducible, and was resected; Paul's tubes were put in. At the end of ninety-six hours an end-to-end anastomosis was effected, and the child recovered. Greig² reported a similar case.

We know that intussusception is a very rare complication of Henoch's purpura, but it does occur; and if a case of Henoch's purpura shows signs of intestinal obstruction, and a tumour can be made out, the abdomen must be opened.

¹ *Lancet*, March 12th, 1910.

² *Scottish Medical and Surgical Journal*, April 1908.

CHAPTER VI

EXAMINATION OF CHILD—THE ANÆSTHETIC

It is useless to expect to make a satisfactory examination of these cases if they are lying on their mother's lap with all their clothes on. To examine a child properly it should be undressed, or have all its clothes loosened and its napkin off. Place it on a blanket or rug on a couch or firm bed. The abdomen should then be palpated carefully with the fingers. If nothing can be made out in this way it should be examined bimanually, the fingers of one hand being placed in the loin, just as in examining the kidney—first on one side, then on the other. The abdomen is often soft and flaccid ; the tumour is not tender, and sometimes undergoes alteration in size and shape while being examined—at one time becoming so soft that it can scarcely be made out, at another hardening again. If there is any distension, or if the child resists or screams, it is quite hopeless to expect to find any mass in the abdomen, even though there be a large one. Under these circumstances an anæsthetic must be given ; indeed, it should always be given for diagnostic purposes whenever you fail to feel a tumour, even though the child did not seem to resist your manipulation in any way. No one need hesitate about

giving CHCl_3 , or open ether, for this purpose. If a second man is handy, and the financial circumstances of the parents permit it, he should be sent for ; but when people are without much means the doctor may give the anæsthetic alone. If he does not care to do this, he should send the child at once to the hospital as a suspected case of intussusception. These babies generally take CHCl_3 well, and in a very short time are sufficiently relaxed to permit of satisfactory examination ; then there is no difficulty in feeling a tumour if there is one.

Nearly all writers on this subject have described the tumour that is felt as a “ sausage-shaped ” mass. Occasionally it may resemble this article of food in size and shape ; more often it does not. The mass felt in early cases is often more rounded than oblong, and about the size of a green walnut. It is sometimes a little difficult to feel, e.g., when it happens (as is often the case) to be at the hepatic flexure of the colon, small, and tucked up under the liver.

In early cases the mass will generally be found on the right side, or in the middle of the abdomen just above the umbilicus. In later cases it is more often found on the left side, in the descending colon or sigmoid ; and we must not forget that sometimes (but very rarely) when we fail to feel it in the abdomen it may be discovered by the finger in the rectum. In searching for it we should go systematically through the abdomen, beginning at the cæcum and following the colon right round. When there is great difficulty

in making out the position of the mass it can be located by a bimanual examination, one finger being in the rectum. When the mass is in the transverse colon it is sometimes very low in the abdomen, and is easily moved about. If oblong, it is always curved, with the concavity towards the umbilicus. When the tumour feels very hard, it is often an indication that there will be very considerable difficulty in completing the squeezing-out process when the mass is reached. As a mass is invariably present in cases of intussusception, it should be possible to make it out if we examine carefully. I can only remember two cases in which I opened the abdomen without first feeling the mass. In these cases there was much distension, but the history and the symptoms were characteristic. I felt certain, too, that if I did not meet an intussusception I should find some other form of intestinal obstruction.

When the mass is once felt the diagnosis is complete. The important point to settle, then, is where and how the child is to be treated. The parents must be told of the seriousness and urgency of the conditions. If it is a case for a public hospital, the child should be sent there at once, with a note to the Medical Superintendent, marked "Urgent," so that there will be no delay about the admission. In the case of well-to-do people, it is far better to get the child and its mother sent to a private hospital or surgical home than to attempt the operation in the patient's house. An intussusception can be operated on in a private house, but there is a better chance of

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recovery when the operation takes place in a properly equipped operating-room.

ANÆSTHETIC.—Until ten years ago chloroform was given for nearly all my cases; now we have ether given on the open mask. Unless the anæsthetist is inexperienced, there should be no difficulty in giving a general anæsthetic to these children; neither are there any bad after-effects. The fact that a hundred consecutive cases of intussusception in this series were operated upon on these lines with only seven deaths is sufficient proof that general anæsthesia is not contra-indicated. Why, then, try spinal anæsthesia?

I notice that young anæsthetists are nearly always nervous when giving an anæsthetic to a baby with intussusception. It is very important that the anæsthetic should be properly administered. Some men are over-anxious, some are too bold, and both are equally dangerous as anæsthetists at any time—especially when one has to open a baby's abdomen. The over-anxious man has the child "light" all the time. It moves when you make the first cut; then, after an interval, it is put under sufficiently to allow you to get to the peritoneum; but, just as this is being opened, at a most inopportune moment, it strains, and the omentum—with some coils of intestine—rushes out. This untoward accident very much increases the risks of the operation. Until the child is got under again, it is almost impossible to return the intestines through the small opening that has

been made, or to make this larger. There is nothing to be done but to place a gauze pad over the bowel to prevent more coming out, and to wait. Meanwhile the intestine may be getting damaged, and the child is feeling the shock.

As house-surgeons are constantly coming and going, one seldom gets the same man to give an anæsthetic for an intussusception more than two or three times. So, more often than not, when operating for intussusception it is the anæsthetizer's first case of its kind. The operator, under such circumstances, should reassure him, and explain to him the dangers of having the child too lightly under the anæsthetic. Nearly all babies get some shock directly the peritoneum is opened. They become pale, the pulse goes off, and the breathing is shallow. This condition naturally frightens most men, and they discontinue the anæsthetic. But the anæsthetic must not be discontinued. To do this only increases the shock; and the child will soon vomit, and thus complicate matters very considerably.

CHAPTER VII

TREATMENT—IRRIGATION

THE TREATMENT FOR INTUSSUSCEPTION IS LAPAROTOMY.—Directly an intussusception has been diagnosed, arrangements should be made without any delay for opening the abdomen.

In former years irrigation was generally adopted as the right method of treatment in these cases; indeed, until thirty years ago it was practically the only treatment considered justifiable. Injections were repeated again and again. Laparotomy was only performed as a last resource, when, of course, the case was in a nearly hopeless condition. Even at the present day treatment by injection is urged by some in place of laparotomy, e.g. by J. Eschen,¹ whose paper is reprinted in the *Medical Review* for April 1919.

When in 1893 (twenty-seven years ago) I first began to see cases of intussusception, opening the abdomen of anybody, especially of a young child, was considered a very much more risky procedure than it is now. At that time, therefore, when we met cases of intussusception we tried irrigation first.

In a paper of mine which appeared in the *British*

¹ In *Ugeskrift for Læger*, December 7th.

Medical Journal of November 1897 I said : “ I think injections of warm oil should be given in all cases, after the child is under the anæsthetic—even in cases of long standing when we know that it is impossible to complete the reduction by these means. My reasons are these : It always reduces the intussusception to a certain extent, and in the best and gentlest possible way ; in this way it lessens the shock of the coming operation, because less manipulation of the intestines is needed. It is especially useful in cases in which we find the intussusception in the rectum ; because, if we do not use it we may find some difficulty in getting our fingers below the tumour to begin the squeezing process.” And for the first 140 cases I always tried this preliminary irrigation, either with oil or normal saline ; but I only succeeded in completely reducing the intussusception in 14 cases, which is exactly 10%.

I never relied upon irrigation as a method of treatment. I was always prepared to operate, and did so at once when I found that the mass had not been reduced by the injection.

Irrigation as a mode of treatment for intussusception should never be compared, as it used to be, with laparotomy. Mr. Jonathan Hutchinson¹ expressed his opinion on this matter with great clearness. In his *Notes on the Operative Treatment of the Bowels* he says : “ It is absurd to institute any comparison between the treatment by insufflation or injection and

¹ *Archives of Surgery*, vol. iv.

that by laparotomy. The rule of practice ought to be invariably to try the former measures in the early stages. It is only when they have failed that laparotomy ought to be thought of. The two measures are not competitive, but one is supplementary to the other. Statistical tables instituting a contrast as regards the relative success of the two measures are mere waste of labour."

Irrigation, then, is a supplementary treatment. It will, nearly always, partially reduce an intussusception; but we know it can only succeed in effecting a complete reduction in a small percentage of cases. It is because men have quite failed to appreciate its limitations that this method of treatment has fallen into disrepute, and is now condemned by most writers on this subject.

Mr. E. Owen, in his address on *What is Intussusception, and How should it be dealt with?*¹ said: "I deem it nothing less than a calamity that physicians have every now and then managed to chase back a bit of bowel by using an enema." He evidently thought it was hopeless to attempt to teach men to use irrigation with discretion. And, seeing that many lives had been lost by expecting too much from this form of treatment, he considered it best that it should be abolished.

The views expressed by Mr. Pitts in opening the discussion on intussusception at the annual meeting of the British Medical Association in 1901 are worth

¹ *Brit. Med. Jour.*, September 7th, 1901.

recording. He said: "The most unsatisfactory feature in attempts at inflation is that you are never sure that you have succeeded in reducing the whole of the intussusception; and in the ileo-colic and enteric forms it is most improbable that success will attend your efforts. It is not so very uncommon to have an intussusception of small bowel into small near the cæcum, and then a further intussusception into the cæcum. Again, in operating on intussusception one cannot but be struck by the considerable difficulty experienced in the majority of cases in effecting a complete reduction, even when the part is manipulated outside the abdomen. . . . It is, then, this uncertainty as to the exact condition of the bowel which makes the surgeon prefer to handle and see the bowel. The length of time which has elapsed since the first onset of symptoms cannot altogether be relied upon as a guide; such swelling may take place in a few hours so as to induce gangrene, or make the reduction by abdominal section and taxis extremely difficult; whilst intussusceptions which have lasted for days, or even two or three weeks, are occasionally reduced with comparative ease and with very little change visible in the bowel after its reduction. What happens in intussusceptions is very much the same in this respect as in strangulated hernia, except that in the intussusception of children swollen mesenteric glands are constantly met with, and often form one of the great difficulties in the final reduction. I would, then, reserve trial by inflation to cases seen within a

few hours of the commencement of symptoms, and then only when the symptoms are not of a very acute form. It follows that most cases seen in hospital are best dealt with at once by operation. In some cases, however, when the intussusception has travelled along the transverse or descending colon, inflation may be employed as a useful preliminary to exploration, and will often limit the field of operation and enable the incision to be made directly over the swelling. Even if complete reduction should apparently take place, it will generally be best to make sure by a small incision ; otherwise there must remain a considerable doubt, and it is highly probable that reduction is not quite complete and will recur, or else will give rise later to a condition of chronic stenosis."

He concludes by saying : " First, try inflation only when the case is seen within a few hours of onset and is not of a very acute character. In the great majority of hospital cases it is better to open the abdomen at once.

" Second, inflation may be tried in certain other cases for the purpose of reducing the main portion of the intussusception and enabling the incision to be made directly over the swelling."

Up to ten years ago I used an injection in every case as a preliminary step when the child was on the table and under the anæsthetic, with everything ready for the operation ; but reduction was only effected in 10% of the cases.

My reasons for using the injections were these : In a

certain small proportion of cases a complete reduction might be effected—which meant a great deal when the mortality was high. Then the injection nearly always reduced the mass to a considerable extent, and thus lessened the subsequent manipulation. But about ten years ago, when the mortality decreased considerably, I omitted the injections as a preliminary stage. And in some “Notes on Intussusception” that appeared in the *British Journal of Children’s Diseases*, July 1909, I said: “Recently I have altered my method by omitting the injection and proceeding at once to the abdominal section. The mortality is now so low, and the manipulation of the intestines, if carefully carried out, is not harmful, that it seems hardly worth while to waste time on a procedure from which so little benefit can be derived.”

Although I personally gave up preliminary injections, further experience has taught me that I was mistaken in saying that but little benefit could be derived from it. I am sure now that the preliminary injection may often be most useful (for reasons given below), and I do not at all agree with the strong condemnation of this form of treatment that is so often expressed.

Soutar,¹ in a lecture on Intussusception at the West London Hospital, under the head of “Treatment,” says: “The only treatment for intussusception is immediate laparotomy. Inflation by the rectum is both useless and dangerous. Useless, because it rarely

¹ *Brit. Med. Jour.*, May 1913.

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even appears to succeed, and because any reduction effected is almost always incomplete and rapidly recurs : dangerous, because it increases shock, wastes valuable time, and may do considerable damage. It was only justifiable when the mortality was 100%."

We all agree that the treatment for intussusception is laparotomy, but to say that inflation by the rectum is "useless and dangerous" is not true. It may be useless, certainly, if you mean to rely on it to reduce the intussusception completely ; but men do not use it with that idea now.

It is not dangerous ; it does not increase shock ; it will never do any damage if properly used.

Another writer on this subject, Romanis, says¹ : "The older methods of inflation by air and water pressure are entirely abandoned, though in a few of the earlier cases of this series such means were employed, as a preliminary measure before laparotomy was performed, in an attempt to reduce the lower part of the intussusception and thus diminish the amount of intra-abdominal manipulation likely to be required later at the operation. But the most that can be hoped from such a procedure is that a few of the lowest inches only of the intussusception will be reduced ; and it is just this lowest part of the invagination that is so easily dealt with in laparotomy, a few seconds almost always sufficing to reduce all the lower part of the intussusception. It is, therefore,

¹ *Practitioner*, vol. ii, 1918.

of very little advantage to the surgeon to find, on opening the abdomen, that a small partial reduction has already taken place."

But it is not a fact that the "most that can be hoped . . . is that a few of the lowest inches will be reduced." If properly given, while the child is under an anæsthetic, an intussusception can be reduced from pelvic colon to cæcum by irrigation. One great advantage of the preliminary injection, which was known and used by Mr. Kellock at Great Ormond Street many years ago, and has recently been adopted by my colleague, Dr. Hipsley, is this : Almost any intussusception can be pushed back by this means to the region of the cæcum. Then, instead of making the incision in the middle line, the abdomen can be opened as if for removal of appendix. Through this opening the intussusception can be easily delivered, inspected, and completely reduced.

I think that in hospital cases injections should not be given with the idea of effecting a complete reduction. If they are given, and there is doubt about complete reduction, the abdomen should be opened to see if this has taken place. And if at any time the abdomen is not opened after an injection has apparently reduced the intussusception, the case should be most carefully watched and seen again by the surgeon within eight hours.

When injections are given, they should be under the immediate personal supervision of the surgeon. They should be given by means of an ordinary

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enema syringe, or by a douche holding 10 ounces, raised 8 feet, and connected by rubber tubing to a No. 12 rubber catheter ; and the child should be on the operating-table, and everything ready for the operation.

CHAPTER VIII

ABDOMINAL SECTION

WHEN an intussusception has once been diagnosed, it is important that the operation should be performed as soon as arrangements can be properly made. It need not be rushed at the cost of imperfect arrangements, but there should be no unnecessary delay.

It is, of course, useless and harmful to continue to feed the child. If it is left in the mother's care while arrangements for the operation are being made, she should be warned not to give it the breast. If there must be great delay, it should be given nothing but small quantities of warm water.

THE OPERATION.—When the child is placed on the table on the hot-water bag, take care that the bag is properly covered and hot (but not too hot—babies are easily burned). The surgeon should always personally direct the administration of the injection. He is responsible. He has to take into consideration the size of the child and the position of the tumour, and has to consider how much fluid to inject and how much force may be used. After injecting about 15 ounces, the fluid generally begins to return. If it is decided not to use any more force, the fluid may now be allowed to escape through the catheter, which can

be detached from the tubing connecting it with the douche ; while this is going on, the abdomen may be palpated. In many cases it will be found that the mass has changed its position, and is now on the right side of the abdomen. Then the operation should be proceeded with, the child's abdomen getting a final clean-up while the surgeon is changing his gloves.

Incision.—The site of the incision depends upon the position of the mass in the abdomen. When it is down on the right side, the incision can be made just outside the rectus ; better still, make the usual incision for the muscle-splitting method of opening the abdomen, commonly used in operations for the removal of the appendix.

When a preliminary injection has not been used, I always open in the middle line, making the umbilicus the centre of an incision which runs, not through it, but curving round it. I usually make a large opening— $1\frac{1}{2}$ to 2 inches above the umbilicus, extending from $1\frac{1}{2}$ to 2 inches below. I think it far better to have the incision too large than too small. In some babies a large amount of fat will be found on the abdominal wall ; such a deposit of fat necessitates an extra long incision. All bleeding should be stopped, and the forceps removed, before the peritoneum is opened. Fine mosquito forceps should be used to pick up the vessels, which should be tied off with very fine catgut.

It is important that the child be well under the anæsthetic before the peritoneum is opened. The

opening of the peritoneum has always a depressing influence, and the child becomes pale; but I think the shock is less if it is well under it, instead of being, in anæsthetic parlance, "light." Directly the peritoneum is well opened, the tumour should be felt for with two fingers. If it is near the cæcum it may be delivered at once, and reduced, when outside the abdomen, by gently pushing and squeezing the mass through the enveloping bowel, upwards from below. Sometimes a considerable amount of pressure has to be exerted before the very last portion unfolds itself. Even if the mass is in the descending colon, it can sometimes be reduced intra-abdominally by means of two fingers, and need only be brought out when it has been coaxed round to the cæcum.

Some men are able, with quite a small incision and one finger in the abdomen, to reduce the intussusception largely. The late Mr. A. E. Barker wrote to me in 1908 on this subject: "I hardly ever make the slightest attempt to see the intussusception until I have reduced it to the last point. This is done with *one* finger in the abdomen, and the thumb of the same hand on the abdominal wall. Between these two digits the squeezing process can be done from below upwards. The incision need only be large enough to receive the index finger freely. In this way, as I pointed out to the students of U.C.H. two days ago, it was easy to reduce an intussusception which had already reached the anus. The child is doing well."

We must not expect all cases to go so smoothly.

Every now and again a case will be met with where more pressure has to be put on the mass than can be effected by one or two fingers in the abdomen. In these cases the mass must be delivered, and then grasped by the whole hand before it moves on. When this is the case, it has to be put into the abdomen before it will pass through the splenic flexure. In long-standing, hard intussusceptions this is a great obstacle, and one of the danger points ; I have seen the colon give way here. If the splenic flexure is safely passed, the transverse colon will not offer great difficulties ; but if the mass has been taken out of the abdomen, it will have to be put back before it will go through the hepatic flexure.

The reduction of an intussusception is always accomplished by squeezing from below upward, *not* by pulling the entering bowel. The first part of the reduction nearly always proceeds rapidly, the only obstacles being the colon bends, where the mesentery is short. In the bad cases the difficulty begins when the mass has been pushed into the ascending colon and gets to the cæcum ; there it often stops and will not budge. You are putting on as much pressure as you dare ; the serous coat of the intussusciens is tightly stretched ; and you think the bowel must rupture if you press any harder. Indeed, you may often see and feel the serous coat crack and tear under your fingers. You have now arrived at a critical moment. Get your assistant to pull very gently upon the entering bowel, while you continue to squeeze and

manipulate the mass, at the same time doing your best to protect the sheath from further stretching. If there is no result from these efforts—not the slightest yielding—the time has come when you must decide how much longer to continue in this way, or whether to desist. No one willingly gives up the attempt to reduce, because the alternative, resection, is fraught with so much immediate danger. It is well, at the same time, to bear in mind that very prolonged attempts at reduction by manipulation produce such intense shock that the child may be quite unable to rally, should it be found necessary to resect. The mass, after resisting pressure for some time, may begin to yield and gradually unfold itself. I have never seen any real adhesions ; the main obstacle to reduction is the œdema of the intussusceptum.

If the intussusception started at the caput cæci—or (in the case of a double one) perhaps a few inches up the ileum—it will be noticed, when the whole mass is apparently reduced, that there is a small, hard, cup-shaped depression at its starting-point. This concavity, which will be at the caput cæci (or, when it starts in the small bowel, at the side opposite the mesentery), must be gently pressed out and made convex. After this has been moulded into proper shape, it must be held in this position for a minute or so, because it often tends to become cup-shaped again when the pressure is taken off.

Even after complete reduction, very considerable thickening of the bowel wall, due to œdema, is often

felt at that part which formed the apex of the intussusception. This thickening might make an inexperienced operator think he is dealing with a growth or a foreign body.

After the reduction is complete, any splitting of the serous coat may be drawn together by a few fine catgut sutures. The damaged bowel should then be carefully washed and returned to the abdomen.

Prolapse of the Intestines.—If possible, the coils of the small intestines should be kept in the abdomen ; but it is quite useless to waste time in fighting with them. Your object is to get at the mass as quickly as possible in order to reduce it and to close the abdomen. And ten minutes or so wasted in fruitless efforts to retain these coils is calculated to do more damage and cause more shock in the end than allowing them to prolapse at once, when there is any difficulty in retaining them while you are searching for the tumour.

When the intestines have prolapsed, there is, of course, no difficulty in finding the tumour. It should be delivered ; and, if it can be reduced easily, this should be done before replacing the intestines. The part of the bowel that has been nipped may well have some hot normal saline poured over it.

To replace the intestines it is necessary to hook up firmly each side of the abdominal wound. As the intestines are being returned, it is a good thing to have hot saline gently poured over them all the time by an assistant. When once the intestines are in, cover them with a gauze pad.

If the intussusception cannot be easily reduced, and when it is evident that there is going to be some trouble in reducing the last part of it, any intestines that may have prolapsed should be returned and covered up with a pad before prolonged efforts are made to complete the reduction.

Should the Appendix be Removed?—I am told that some gynæcologists cannot resist the temptation to remove every appendix they catch sight of. I strongly advise men operating for intussusception not to give way to this temptation. In most intussusceptions the appendix will be found to be much discoloured, but unless it is black it should be left alone. In the 253 sections I have done I only found it necessary to remove it in three cases. The discoloured appendix soon recovers itself. The removal of the appendix, although it may only take a few minutes, must be an additional shock to the child, and may just turn the balance against it. This routine removal of the appendix, and any of the devices to shorten the mesentery or anchor the cæcum, with a view to prevent recurrences, are examples of misdirected surgical zeal, and should not be followed by any man who wishes to keep down his death-rate.

Closing of the Abdomen.—When the incision is in the middle line, often the most difficult part of the operation for intussusception is the closing of the abdomen. It is very difficult to sew up in layers, because the peritoneum is so very thin and tears so easily. There is great difficulty in preventing the

thin feathery omentum from being caught in some places by the catgut. If we overcome this difficulty, and get the peritoneum together, we must not rely entirely on catgut for the other layers. It is better to put a few "silkworms"—the skin and aponeurosis—to reinforce the catgut.

More often than not I close the abdomen by means of through-and-through silkworm-gut sutures, using a small Reverdin's needle. After two are passed at either end of the wound, the gauze pad can be removed. The assistant now, by means of the long uncut ends of the silkworm-gut sutures, is able to hold up the abdominal wall and keep it well away from the omentum while the rest of the sutures are being put in. The edges of the skin are then brought together by horsehair or fine catgut.

The advantage of the through-and-through silkworm-gut sutures is that they can be put in very quickly indeed; the operation is thus shortened. The disadvantages, especially in fat children, are that they may cut into the skin and superficial suppuration may supervene. They are also sometimes difficult to remove.

When the opening is made in the right iliac region by the muscle-splitting method, it is very much easier to close. The peritoneum here is much more easily sewn up, and the rest of the wound is easily closed by means of chromic gut sutures. The tendency to burst open here is not nearly so great as when the opening is in the middle line.

CHAPTER IX

RESECTION

IN the 253 cases I have operated upon, the bowel had to be resected sixteen times. That is to say, we must expect to find the bowel gangrenous or irreducible in about 6% of the cases. Successful cases of resection for intussusception have been reported from time to time in the last twenty-three years (my first successful case was on September 28th, 1896); yet writers on this subject, even at the present day, continue to deny that there are any successful cases on record of resection of the bowel in babies for intussusception. For instance, ten years after this case was recorded, C. H. Fagge, writing on "Intussusception in Infants,"¹ said, "I believe there is no recorded case of recovery under one year."

Soutar, in a lecture on "Intussusception" re-published in the *British Medical Journal* of May 10th, 1913, said: "Resection is attractive, but unjustifiable unless gangrene is present, for there is no recorded case of an infant under one year surviving this operation."

W. H. C. Romanis, in a paper on "The Surgical Treatment of Intussusception," wrote²: "If, however,

¹ *Practitioner*, vol. ii, 1906.

² *Practitioner*, vol. ii, 1918.

an irreducible intussusception occurs in a younger child of one or two years of age, the outlook is altogether different; for recovery after resection is practically unknown in a child of this age, and the operation is well regarded as hopeless.”

In the next paragraph he quotes Fairbank and Vickers’ successful resection for intussusception in a child of seven months, recorded in the *Lancet*, February 1910.

But the very remarkable case reported by Charles Dowd, of New York,¹ in which—the intussusception being irreducible—he successfully removed one-third of the colon in an infant five days old, is altogether ignored, as are all the other cases that have been recorded from time to time.

I have collected 16 cases of recovery after resection for intussusception in children. Fifteen have been recorded; in Appendix A I give dates and references. Dr. Wade’s case, done in February 1920, has not yet been recorded.²

Out of my own 16 cases of resection, I had only 2 recoveries—a death rate of 87·5%—about the same mortality that was met with thirty years ago after any section for intussusception in young children.

¹ *Annals of Surgery*, vol. i, 1913.

² Dr. D. Stephens, of Melbourne, tells me that he has resected the bowel three times successfully. This brings the number of successful resections up to nineteen. Very likely there are many more. In addition, there are three cases on record where lateral anastomosis, without resection, was successful. The references to these will be found in Appendix A.

As in about 6% of all cases we must expect to find the intussusception gangrenous—or irreducible from swelling of the intussusceptum—we ought to be prepared, especially in cases of forty-eight hours' duration, to face this difficulty. In the gangrenous cases we know at once that something further must be done; but in cases not gangrenous, which refuse to unfold because of the œdema of the intussusception, it is sometimes difficult to decide when to leave off squeezing. We feel, perhaps, that at any moment it will begin to unfold; and we know that, if we succeed by this way, the chances for the child are infinitely better than in any other method of treatment. On the other hand, we know that, if we squeeze too much, we are adding to the shock and lessening the child's chances of surviving whatever method we mean to adopt to deal with the difficulty.

There are several ways of dealing with gangrenous, or irreducible, intussusceptions when we meet them:

1. Resection of the mass (which generally involves the cæcum) and end-to-end anastomosis.
2. End-to-end anastomosis with button or bobbin.
3. Closure of both ends, and lateral anastomosis.
4. Resection of bowel with Paul's tubes left in the ileum and colon.
5. Resection of intussusceptum by the method known as Barker Maunsell's or Jesset's.
6. The mass can be left alone and lateral anastomosis (ileo-colic) done (Rutherford's method).¹

¹ *British Journal of Children's Diseases*, September 1909.

Dowd's case¹ ought to be more widely known. The child was born on Monday, December 30th, 1912, and appeared to be normal until the following Friday at 2 a.m. He then began to cry, seemed to be in pain and vomited: the crying continued on and off for two hours. He then became quiet, and remained quiet until the forenoon. At 4 p.m., ten hours after the onset of symptoms, he had a bloody stool. He was seen by Dr. Martin four hours later. At that time a mass could be felt in the abdomen and, by finger, in the rectum. A diagnosis of intussusception was made, and the people were told to take the child to the St. Mary's Hospital for Children; it was not, however, taken there till the following afternoon. Thus he was not operated upon till thirty-seven hours after onset of symptoms. He was not a promising subject, as he only weighed 6½ lb. The mass could be felt in the rectum, close to the anus, and on the left side of abdomen. "After a long incision had been made through the right rectus, the intussusceptum could be pushed up until its apex was a little above the sigmoid flexure. It was impossible to push it farther than this; and, although very careful efforts were made, the coating of the bowel began to split in several places, and the effort had to be abandoned. During this time the child lay on the table in a condition of profound prostration. Dr. Farr, who was giving the anæsthetic, said that he could hardly be sure that he was alive, excepting for

¹ *Annals of Surgery*, vol. i, 1913.

the fact that the pupils did not dilate; the pulse could not be felt, and respiration consisted of nothing more than an occasional shallow gasp. It was evident that the only chance of saving the child's life was resecting the intussuscepted portion of the intestine. This, therefore, was done. The intestine was removed from above the middle of the transverse colon to the upper portion of the sigmoid colon, and its mesenteric vessels tied. Both ends of the remaining intestine were invaginated by means of purse-string sutures, and a lateral anastomosis was quickly made without clamps—silk being used for the outer line of stitches, and chromic gut for the inner line, which included all the intestinal layers. The abdominal wound was closed, a hypodermoclysis was given in each axilla, and the child returned to the ward in a condition rather better than that which he had shown at the earlier part of the operation. The child had a bowel movement on the first day, and on the second day passed reasonable stools. His subsequent recovery was uneventful."

In a case reported by Dr. Collinson, of Preston,¹ the child was only three months old. The symptoms of intussusception were quite typical, and the operation was performed seventeen hours from onset. An elongated tumour was felt, mainly to the left of the middle line. When the abdomen was opened, the mass was reduced to the last 4 inches; it was then brought out of the abdomen and found dusky in colour, and the serous coating was beginning to split.

¹ *Lancet*, October 1907.

The bowel was clamped and the mass excised; the ends were brought together by the help of a Mayo Robson's bobbin. The after-history was uneventful. The part excised was found to be $2\frac{1}{2}$ inches of the ileum, the cæcum and a small part of the ascending colon—7 inches in all.

My first case of resection was done on a child eleven months old in a private house (September 28th, 1896). The child was under the care of Dr. Wood, and had symptoms of intussusception for eight days. The obstruction had not been complete, as the child passed motions each day until forty-eight hours before the operation, when it became distended. This was evidently a chronic form of intussusception that became acute. The ileum was found to be in the cæcum, and was reduced with great difficulty. When it was at last reduced, the ileum was found so much and so irregularly torn that it was not possible to mend it. I therefore excised 4 inches. I had no clamps with me, so I used drainage tubing held by artery forceps. The bowel was joined end to end by means of a double row of catgut.

The child got quite well. When he grew up he enlisted and did his duty in the Great War that has just ended.

My second successful case¹ was a child aged six months; it was admitted to the Children's Hospital thirty hours after onset of symptoms. The abdomen was opened in the middle line. Intussusception was

¹ Reported in the *British Journal of Children's Diseases*, July 1st, 1909.

found in the sigmoid flexure. When nearly reduced, the cæcum was found to be gangrenous.

At this stage the shock was profound, and it was evident that the operation must be terminated as soon as possible. I quickly resected the cæcum and several inches of the ascending colon, and put Paul's tubes in the ileum and colon. For the first twenty-four hours, as it vomited breast-milk, it was fed through the Paul's tube with small quantities of Bengel's food. The tubes came out on the second day. The child was kept on the breast, and gradually began to pick up. For some weeks there was considerable difficulty with the wound and surrounding skin, which was much irritated. The skin recovered itself, and the wound healed up with the exception of two small openings into the bowel. On July 15th, two and a half months after the first operation, the child being in good condition, I was able without any difficulty to make an end-to-end anastomosis. The child quickly recovered, and was sent home.

I think Dowd's very remarkable case should encourage us all when confronted with an irreducible intussusception. It shows what can be done under the most desperate circumstances. It also shows the amount of recuperative power possessed by the youngest infant. No one can say now that it is not possible for an infant to recover after resection for intussusception. It is not wise to lay down the law as to the particular method we should adopt for

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dealing with irreducible intussusceptions ; let each man decide for himself at the time, taking all the circumstances of the case into consideration, as to the means he thinks will give the best chance of recovery.

CHAPTER X

AFTER-TREATMENT

THE dressing of the wound after the operation is over requires care in these cases. If you allow dry gauze to be put on, with narrow strips of wool, piled one on the top of the other, on the gauze, and try to keep this dressing in place by means of a many-tailed bandage, you will find in a very short time that the dressing is on the child's back instead of its abdomen. Sometimes it is wise to damp the first gauze with saline, placing dry gauze on it—this prevents slipping ; then a pad of wool should be placed on either side of the gauze, and a layer of wool should go right round so as to cover the child's back and sides as well as the abdomen. This should be kept in place by means of an ordinary $2\frac{1}{2}$ -inch roller bandage snugly (but not too tightly) applied. While this is being put on the child can be held by two nurses—one holding the head and shoulders, the other the legs and thighs.

The dressing should be readjusted every day—oftener if necessary. We should never be anxious to remove the stitches too quickly, and never remove them before the tenth day. More than once in earlier days I saw an abdomen burst open and the intestines in the bed, because an over-zealous house-surgeon had ventured to remove all the sutures too soon.

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The immediate after-treatment consists in taking measures to combat the profound shock from which some children are sure to suffer. In some cases, especially those caught early, there is very little shock ; no special treatment is required, but the child is given sips of boiled water as soon as it wakes up from the anæsthetic. These children always seem thirsty, and often drink two or three ounces of cold boiled water in the first few hours.

From four to six hours after the operation most children can be given the breast ; the first time they should only be allowed to suck for two minutes. After an interval of two hours, if there has not been much vomiting, they may be allowed to have the breast again, this time for four minutes. If this is not vomited, the child may on the next occasion be allowed to suck for its usual time ; after that the breast should be given every three or four hours—according to the age of the child. After the first two or three times there is no reason why the mother should not be allowed to take the child out of the bed into her arms to give it the breast instead of leaning over the cot. If the child is not at the breast it should be given the food in use when it was taken ill, if that food is at all suitable—but always in very small quantities for the first few times.

At the end of twelve hours the child's bowels are always washed out with normal saline or weak Condyl's fluid ; this washing may be repeated as often as necessary.

Cases involving profound shock require special treatment. Hot bottles are placed round them. Warm saline may be put into the rectum, and the treatment repeated again and again with small quantities. Pituitrin may be given frequently, and strychnine may be ordered. The child should be given sips of boiled water constantly if it will take it.

There are many disadvantages in giving babies saline subcutaneously after they are out of the anæsthetic. In desperate cases it may be given while the child is on the table; personally, I would not order it after the child had been taken back to bed. The disadvantages must be obvious to anyone with practical experience; and I think more harm than good is done by its use.

If the child is not responding to treatment, alcohol may be given by mouth—fifteen to twenty drops in two teaspoonfuls of water every hour. If the shock is passing off, food in small quantities may be given at the end of six or eight hours. If the child is on the breast and is too weak to suck, the milk may be pumped or two or three teaspoonfuls can be given out of a spoon.

In many cases the temperature rises to 102° or 103° F., and the pulse is always quick—160 to 180. If all is going well this reaction gradually subsides, and the pulse-rate and temperature drop to normal in three or four days.

Distension is a bad sign, especially if the bowels have not acted freely; then there is often vomiting.

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Cases with these symptoms are not always hopeless, but they require energetic treatment. The bowels must be washed out frequently. Pituitrin can be given every two hours ; half a grain of calomel may be given by mouth, and repeated in two hours. This treatment suffices for most cases ; after a time some fæces are passed, the distension goes down, and the vomiting ceases.

I have never had to reopen the abdomen within a day or so for a recurrence. The partial obstruction that gives rise to these symptoms is probably due to partial paresis of some part of the bowel that has been injured by being intussuscepted. If peristalsis is stimulated by the means recommended above to overcome distension, the bowel gradually rights itself.

The cases that die very often succumb quite quickly (in a few hours) to shock ; but some hang on for twenty-four hours or more, yet never really get over the shock, and die in the end. Some, I am sure, die from peritonitis, as organisms may get through the damaged bowel in a case that has been very difficult to reduce.

RECURRENCES.—A recurrence, following a supposed complete reduction by injection (or inflation), does often occur, and must always be expected. But a recurrence coming on immediately, or even soon after, a reduction has been effected by laparotomy is very rare. In my series of cases I have only met with two recurrences. One was a colic variety ; when it recurred in six months it was found to be colic again. The other case of mine that recurred was in a child

aged five months. The first time the intussusception was a double one—ileo-colic-colic variety—this recurred in two months, when the intussusception was found to be of the ileo-colic (now called enteric) variety.

Dr. Hipsley, in his paper on a “Résumé of Fifty-one Cases of Intussusception,”¹ gives remarkable instances of multiple recurrences. One child, aged five months, was operated on three times within three weeks; each time the apex of the intussusception was found to be the tip of the cæcum, and on the last occasion he stitched this to the peritoneum in the region of the iliac fossa. The other child mentioned by Dr. Hipsley was nine months old when he first saw it. It had been operated on for intussusception when three months old. At the operation he found the intussusception to be of the ileo-cæcal variety, extending into the transverse colon, and easily reduced. Eleven months later it was brought back with the usual symptoms; when operated on, the intussusception was again found to be ileo-cæcal, and was easily reduced. Five months later it was operated on in another hospital for intussusception, and recovered.

Recurrences, then, do take place, but only in a very small percentage of the cases; it is, therefore, unnecessary to make any attempt to anchor the cæcum as a routine method of treatment when operating for intussusception. But if a recurrence is met with, where the intussusception again starts at the cæcum, then we may make some attempt to prevent another

¹ *Medical Journal of Australia*, November 9th, 1918.

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recurrence by fixing the cæcum to the peritoneum in any way that seems best at the time.

As to the giving of morphia in these cases just after the operation, in the first edition of this book I advocated that line of treatment ; but further experience has taught me that morphia may do a great deal of harm. It should never be given as a routine treatment, though it may be necessary in a few cases. If children are very restless, crying, and obviously in pain, then a very small dose of morphia is useful ; but it should be reserved for these exceptional cases.

In hospitals for children, and in children's wards in adult hospitals, it is most important to take every possible care to prevent intussusception cases from contracting gastro-enteritis (summer diarrhœa) after operation from other children in the same ward. This is a very real danger in the summer months : I remember two or three cases that were lost some years ago in this way alone ; the child had got over the operation, and was doing well, when it contracted gastro-enteritis from another child in the same ward. That they succumb readily is only what one would expect.

In large children's hospitals gastro-enteritis cases should be rigidly kept out of surgical wards. In adult hospitals, with only one children's ward, it is quite likely that there will be cases of diarrhœa during the hot weather : it is, therefore, advisable that a child operated upon for intussusception should not be admitted to the children's ward of an adult hospital, but should be sent to a female surgical ward instead.

APPENDIX A

LIST OF CASES THAT HAVE RECOVERED AFTER RESECTION OF THE BOWEL FOR INTUSSUSCEPTION IN BABIES

Name of Surgeon.	Age of Child.	Date.	Where Recorded.
Clubbe. .	11 months	28.9.1896	<i>Brit. Med. Jour.</i> , vol. ii, 1897
Collinson .	3 „	21.10.1906	<i>Lancet</i> , October 19th, 1907
Collinson .	4 years	Sept. 1907	<i>Lancet</i> , March 12th, 1910
Peterson	4½ months	—	<i>New York Record</i> , 1908, 438
Clubbe. .	6 „	April 1908	<i>Brit. Jour. Dis. Children</i> , July 1909
Fairbanks & Vickers	7 „	—	<i>Lancet</i> , February 5th, 1910
Flint . .	11 „	—	<i>Proc. Conn. Med. Soc.</i> , 1911, vol. cxix
Woolfenden	3 „	—	<i>Med. Press & Circular</i> , vol. xciv
Hughes .	6 „	—	<i>Lancet</i> , September 1912
Dowd . .	5 days	Dec. 1912	<i>Annals of Surgery</i> , vol. i, 1913
McKelvey.	6 months	Nov. 1921	<i>Med. Jour. Australia</i> , Feb. 17th, 1917
Hipsley .	7 „	June 1916	<i>Med. Jour. Australia</i> , January 13th, 1917
Rischbieth	4 years	—	<i>Med. Jour. Australia</i> , Feb. 7th, 1920
Dunlop .	1 year	—	<i>Med. Jour. Australia</i> , March 6th, 1920
Wade . .	3 months	Feb. 1920	Not yet recorded

Lateral Anastomosis—Mass not Resected

Rutherford	4 months	7.3.1906	<i>Brit. Jour. Dis. Children</i> , September 1909
Parry . .	6 „	June 1908	<i>Pro. Royal Society of Med.</i> , vol. ii, 1909
Bullock .	7 „	—	<i>Med. Jour. of Australia</i> , July 17th, 1920

Dr. Douglas Stephens, of Melbourne, writes that he has resected the bowel three times successfully in children suffering from acute intussusception ; so far, he has not recorded the cases.

There is also Coffey's case (*Annals of Surgery*, vol. i, 1907). But this child was seven years old ; a pedunculated growth in a Meckel's diverticulum became gangrenous after it was intussuscepted, and was successfully resected by a method which is fully described.

APPENDIX B

EXAMPLES OF CASES CURED BY INJECTION ALONE

CASE 8.—E. G., aged 6 months. Admitted to the Children's Hospital, July 19th, 1895.

History.—Thirty hours ago screamed and turned pale. Passed blood eight hours later. Vomited several times. Under chloroform a tumour felt on the right side of the abdomen. Warm olive oil was injected, and the mass disappeared. In a few hours the child passed three motions; no vomiting. Child was discharged next day, as it was not weaned, but it was kept under observation for several days, and remained quite well.

CASE 11.—E. C., aged 5 months. Admitted to the Children's Hospital, July 30th, 1896.

History.—Began to scream two days ago, and soon vomited and passed a motion consisting chiefly of blood and slime. Under chloroform cylindrical tumour, extending boomerang-like, in region of hepatic flexure of colon. Warm olive oil was injected, and the tumour was reduced partly by the oil, partly by manipulation.

July 31st.—The child seems quite well; has had several motions, no vomiting; discharged cured.

CASE 16.—V. R., aged 15 months. Admitted to the Children's Hospital, November 5th, 1896.

History.—Was taken ill suddenly seven hours ago, and seemed to be in a great deal of pain. In two hours it

started vomiting, and two hours after that it passed blood. Under chloroform a tumour could be felt in the right hypochondrium. Warm olive oil enema was given, and the mass disappeared.

November 6th.—Has not vomited since the injection. Passed a good night, and seems very well. Has had five motions. First four contained a little blood. Discharged cured.

CASE 62.—W. A., aged 5 months. Admitted to the Children's Hospital at 10.30 p.m., September 16th, 1901.

History.—About four o'clock in the afternoon child seemed to become suddenly faint, white, and collapsed, and started screaming. A little while after started retching, and also passed blood.

Has continued retching and passing blood ever since. Has passed no motion or flatus since 4 p.m.

On Examination.—Mass can be felt in ascending and transverse colon. Baby very white. Pulse quick.

Under CHCl_3 injection of warm olive oil was given; the intussusception was reduced. The child made an uninterrupted recovery.

CASE 97.—M. W., aged 9 months. Admitted November 11th, 1903.

History.—Ill since 4 p.m. yesterday. Onset sudden, with evidence of abdominal pain; became pale and weak. At 5 p.m. passed motion mixed with blood and slime; vomited at 8.30 p.m. after breast, and again at 2 a.m. At 9 a.m. found blood and slime again.

Previous History.—No diarrhoea. Healthy child from birth.

On Examination.—General condition fairly good. Under anæsthetic mass felt in right upper aspect of abdomen. Oil injected, after which mass could not be felt.

November 12th, 1903.—General condition good, no sign of recurring.

November 13th, 1903.—Child quite well.

CASE 223.—June 3rd, 1913. R. M., male, aged 12 months.

History.—Taken ill twenty-six hours ago with typical history ; screamed, got pale, soon vomited ; nine hours afterwards passed blood, vomited again two hours after that.

Under anæsthetic a small hard mass felt on right side. Given an injection of normal saline. Afterwards no mass could be felt. A few hours afterwards the child passed blood-stained motion. Child kept in hospital two days and then discharged well.

EXAMPLES OF RECURRENCES AFTER LAPAROTOMY, THE INTERVAL IN ONE CASE BEING SIX MONTHS, AND IN THE OTHER TWO

CASE 26.—R. C., aged 2 years and 2 months. Admitted to the Children's Hospital, February 21st, 1898, at 2 p.m.

At 7 p.m., February 20th, he complained of pain in the abdomen, threw himself on the floor, and got white ; since then he has passed blood and slime frequently from the bowel. At present general condition of the child is good. In right iliac and umbilical regions a fairly large hard mass can be felt. *Per rectum*, a mass not far from anus can be felt, and the lumen of the intussusceptum can be distinctly made out.

Under chloroform, after an injection of warm olive oil, which very much reduced the size of the mass, an incision was made in the middle line, beginning just above the umbilicus. The intussusception was delivered and reduced

without much difficulty. It was colon only, beginning just below the cæcum ; wound closed ; gauze drain left in.

February 22nd, 1898.—Temperature, 102 ; pulse, 160. Not much pain ; has passed mucus ; no blood. Had small quantities of morphia hypodermically three times during the night. Temperature, 104 at 10 p.m. (when he was sponged) ; passed a fair motion ; more morphia, as he was still restless.

February 23rd, 1898.—A partly formed motion ; took his food well and slept well.

February 27th, 1898.—Has had diarrhoea on and off ; fed on Benger's food one-third milk. He had a stitch abscess, but he ultimately made a good recovery and was discharged cured on March 20th, 1898.

CASE 27.—R. C., aged 2 years and 8 months. Admitted again to the Children's Hospital, September 20th, 1898, at 2 p.m.

This child was discharged cured from the hospital after a laparotomy for intussusception six months ago. The father states that the child was taken suddenly ill that morning with the same symptoms he had had on the previous occasion, therefore he thought it best to bring him straight to the hospital again.

On admission, the child does not look very ill ; he has been vomiting and passing blood by the bowel. At 4 p.m., under chloroform, a large injection of warm olive oil was given, which seemed to reduce completely the mass which had previously been felt in the region of the transverse and descending colon. The child was taken back to the ward. On examining the child a few hours later, the tumour was found to have returned.

Under chloroform the abdomen was opened in the middle line. The intussusception, which was colon into

colon, was easily reduced, and child afterwards made an uninterrupted recovery.

CASE 69.—A. S., aged 5 months. Admitted to the Children's Hospital, March 22, 1902.

Started vomiting yesterday afternoon, and this has continued.

About nine o'clock last night had a screaming fit. Very restless all night, screaming at intervals. Early this morning child passed a normal motion, and soon afterwards passed bright blood, wetting napkin through.

On Examination.—Child collapsed. Temperature, 98·8; pulse, 148; respiration, 36. Abdomen soft, easily palpable.

In left iliac region is to be felt sausage-shaped tumour.

Intussusception can be palpated *per rectum*.

10 *a.m.*—Under chloroform, abdomen opened over appendix by a vertical incision passing through the rectus, after an injection had reduced the greater part of the intussusception.

Intussusception found ileo-cæcal; reduced bowel somewhat nipped, was healthy.

Abdomen sutured with silkworm-gut through and through. Discharged cured.

CASE 73.—A. S., aged 7 months. Admitted again to the Children's Hospital, May 15th, 1902.

About three hours ago child fidgety. Began to scream. Went to sleep about a quarter of an hour. More screaming and straining. Vomited about half an hour from first scream; vomited a little since.

Straining to pass motion, but bowels not open. No blood.

Previous History.—Operated on for intussusception two months ago.

On Examination.—Under chloroform, tumour in position of ascending and transverse colon. Under chloroform and ether, mass partly reduced by olive-oil injection. The old scar (to right of middle line) made the seat of incision. Many adhesions in neighbourhood.

The intussusception brought into wound and reduced (of the ileo-cæcal variety). The appendix long. A number of adhesions separated between small intestine and parietal wall round edges of wound.

Wound united with through-and-through fishgut sutures.

A good deal shocked. Pulse almost stopped at one period of operation, but recovered greatly later on.

Discharged cured in fourteen days.

RETROGRADE INTUSSUSCEPTIONS

CASE 116.—C. P., aged 9 months. Admitted November 11th, 1904.

Child ill since twelve o'clock to-day. Began with a fit of screaming, then vomited. Four hours later bowels opened slightly; motion and blood. Later still, child passed a quantity of blood and slime.

On Examination.—Child pale, pulse rapid; abdominal walls lax; large tumour to be found above and to the left of umbilicus.

Under Ether.—Oil injected, tumour reduced to right iliac fossa. Abdomen opened in middle line, intussusception (ileo-cæcal variety) found to be very tight. During reduction peritoneum torn in several places. *In small intestine there were three or four small intussusceptions, retrograde, each about $1\frac{1}{2}$ inch of gut;* these were reduced easily. The wound was then closed with silkworm-gut and horsehair.

The next day, November 13th, 1904, child very well. No vomiting. Pulse good; temperature normal.

After a slight attack of diarrhoea this child made a rapid recovery.

CASE 124.—W. J., aged 4 months. Admitted May 1st, 1905.

Ill since April 29th, 1905. Began to cry a great deal and was restless all night. Last night she screamed a lot; bowels naturally opened till six this morning. Bowels opened at 8 a.m.; motions green with white lumps—foul. Vomited a large quantity this morning. At 10 a.m. passed blood with motion, blood quite red.

Under chloroform and ether, large mass felt in the left iliac fossa. An attempt was made to reduce with oil, without result. Mass delivered and reduced. The intussusception was of the ileo-cæcal variety; but the mass, after reaching the descending colon, appeared to form a retrograde movement *en masse*, and to be invaginated into the colon higher up the bowel. So, in reduction, pressure first in one direction, then in the opposite, was necessary. Wound closed with through-and-through silkworm-gut sutures.

May 2nd, 1905.—Child restless all night; pulse good; temperature, 99. Abdomen somewhat distended, bowels opened with injection, passed flatus, motions green, curdy, and foul.

May 3rd, 1905.—Child very well. Motions natural. Takes food well. After this the child made a rapid recovery.

EXAMPLE OF INTUSSUSCEPTION OCCURRING DURING AN ATTACK OF DIARRHŒA

CASE 117.—A. B., aged 8 months. Admitted November 30th, 1904.

Child has had vomiting and diarrhoea for about three

weeks, motions green and slimy. Had bowels opened three times yesterday, last time about 4 p.m. Has been much worse during the last twenty-four hours. Passed blood (no motion) at 8 a.m. to-day.

On Examination.—Child very pale; vomited off and on. Holds abdomen very tight; very difficult to examine.

Under chloroform, mass felt in left lumbar region. Oil injected; mass reduced in size.

Incision in middleline. Bowels prolapsed from abdomen. Intussusception reduced and bowels returned. Intussusception was of the ileo-cæcal variety. Abdomen closed in single layer.

December 2nd, 1904.—Child very well, taking food well; Temperature normal.

December 4th, 1904.—Child has had diarrhœa.

December 7th, 1904.—Child very well. Temperature normal. Still has slight diarrhœa.

This child was discharged cured on December 19th, 1904.

CASE OF INTUSSUSCEPTION WHERE GRAPE-SEED AND THREAD-WORMS WERE FOUND IN APPENDIX

CASE 67.—T. H., aged 10 months. Admitted February 4th, 1902.

At ten o'clock this morning child had a screaming fit and commenced retching; retched up grape-skins. Has passed no motion since. Was given an enema, and passed some reddish fluid.

On Examination.—Temperature, 101·6; pulse, 150; respiration, 54.

Under Chloroform.—Intussusception palpated in upper part of abdomen. Attempt made to reduce it with oil. Abdomen opened in middle line. Small portion of intussusception, ileo-cæcal, still found unreduced. After reduc-

tion, appendix found to be very dark. Appendix removed and found to contain a grape-seed and two or three small thread-worms.

Later.—Child restless; temperature, 103. Given morphia; child did not rest very well.

February 5th, 1902.—Injection this morning; child passed some grape-seeds and seemed easier afterwards.

February 6th, 1902.—Another injection last night; passed more skins and seeds; no worms to be seen in motion. Had another good motion this morning after oil. Passed still more seeds and grape-skins. Seems much easier. Wound looking well. Temperature, 99; pulse, 120.

Child was discharged cured on February 20th, 1902.

SEVERE CASES—PERITONEUM TORN—RECOVERY

CASE 104.—M. T., aged 5 months. Admitted June 29th, 1904.

Child quite well till midday yesterday, then commenced vomiting. Cried a little, but no screaming. 9 p.m. yesterday commenced passing blood and slime. Vomiting continued. Child could take no food.

On Examination.—Child very pale, pulse rapid and small.

Abdomen.—A curved tumour readily palpable in left iliac region.

Under Chloroform.—Olive oil injected into bowel, but no reduction in size of tumour. Incision made in middle line 2 inches above and 2 inches below umbilicus. Wound bled freely, oozing stopped by ligatures and adrenalin. Almost whole of colon involved in ileo-cæcal intussusception. Intussusception reduced after some difficulty. Cæcum much discoloured. Peritoneum ruptured in several places. Some of the rents were stitched

over ; bowels returned into abdomen, which was sutured in a single layer.

July 1st, 1904.—Child very well. Bowels well opened. No distension.

This child made an uneventful recovery, and was discharged on July 17th, 1904.

CASE 105.—J. P., aged 9 months. Admitted June 30th, 1904.

Child perfectly well up to midday yesterday, then commenced vomiting. Passed blood and slime after injection. At 10 p.m. yesterday cried a good deal. Got very pale after attack came on.

On Examination.—Child somewhat pale. Abdomen tense. Tumour felt in right upper hypochondrium.

Under Chloroform.—After an injection of oil, incision $2\frac{1}{2}$ inches long made on right side of rectus. Intussusception withdrawn from abdomen ; whole of ascending and part of transverse colon involved. Intussusception reduced by pressure, the last few inches very difficult to reduce. On reduction it was found that the primary intussusception had taken place at the lower end of ileum. Serous coating of gut torn in one place. Intestines returned to abdomen.

July 1st, 1904.—Child very well. Bowels well opened.

July 2nd, 1904.—Wound looks well. Child taking food well. Temperature normal.

July 12th, 1904.—Two silkworm-gut sutures removed. Child very well. Discharged 10 a.m. To come up to be dressed daily.

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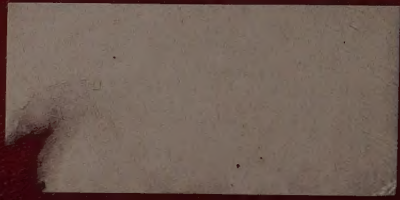
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